
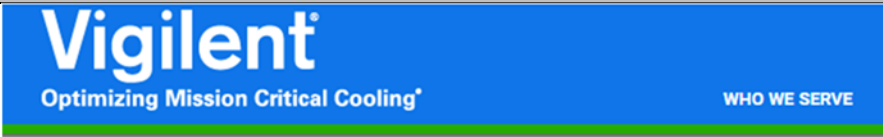


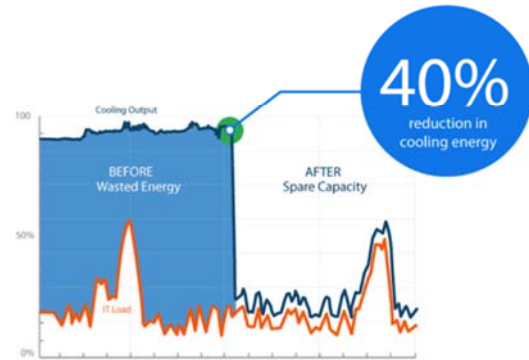
Exhibit 8

U.S. Patent No. 6,854,287 – Infringement Claim Chart

Claim 1	Exemplary Evidence of Infringement by Digital Realty
<p>[1pre] A method for cooling a room configured to house a plurality of computer systems, said method comprising:</p>	<p>Digital Realty’s data centers use a method for cooling a room configured to house a plurality of computer systems.</p> <p>For example, Digital Realty uses Vertiv (Liebert) cooling units in each colocation data center. Liebert cooling units are controlled by Liebert’s iCOM Intelligent Communication and Monitoring system.</p> <div data-bbox="762 545 1997 1240">A video frame showing a man in a grey short-sleeved shirt and glasses standing in a data center aisle. He is reaching out with his right hand to touch a small, square, illuminated control panel mounted on a tall, grey server rack. The aisle is lined with similar server racks, and the floor is a light-colored tile. The lighting is bright and even. At the bottom of the frame, there is a video player interface with a red progress bar, play/pause buttons, a volume icon, and a timestamp of 1:43 / 3:23. The text 'Customer Support' is visible next to the timestamp.</div> <p>https://www.youtube.com/watch?v=OmV1SFy5cEg at 1:43.</p> <p>Digital Realty also, or alternatively, uses Vigilent’s dynamic cooling management which provides cooling to the server racks of a data center.</p>

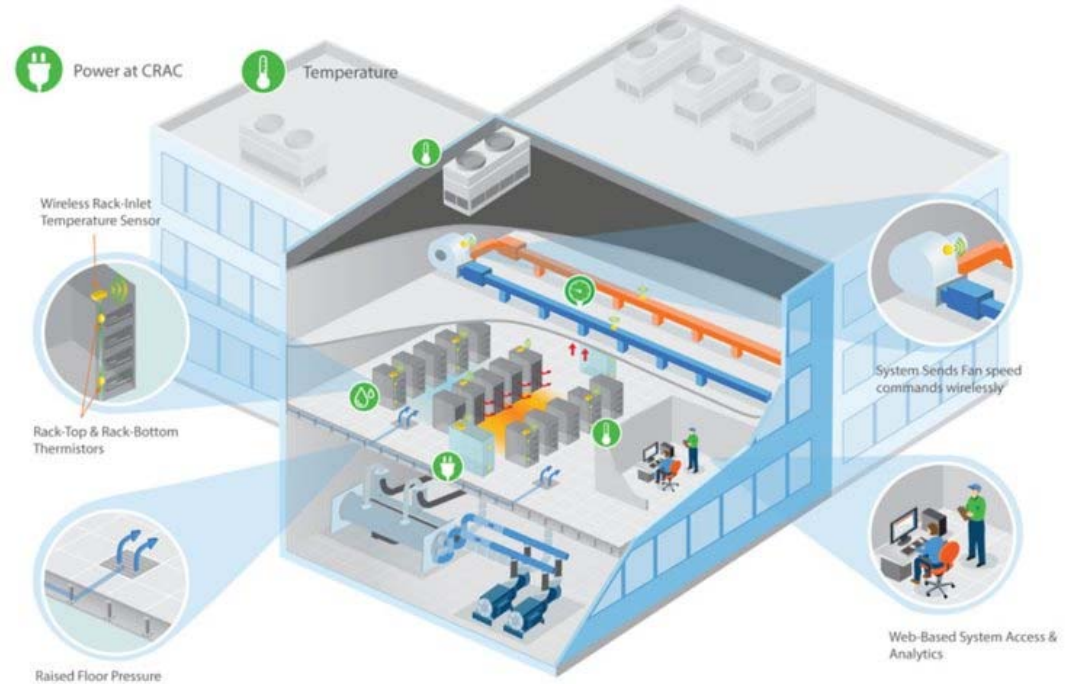
Claim 1	Exemplary Evidence of Infringement by Digital Realty
	 <p data-bbox="978 500 1297 542">DIGITAL REALTY</p> <p data-bbox="978 581 1797 863">“We found that upgrading fans and adding fan speed controls in our data centers allowed us to cool them more effectively and efficiently. In addition, the facility’s electrical energy usage was reduced, as was the average and peak electric power demand, resulting in a more energy efficient and sustainable data center environment.”</p> <p data-bbox="978 873 1776 909">– Jim Smith, Chief Technology Officer, Digital Realty</p> <p data-bbox="758 961 1264 993">https://www.vigilent.com/digital-realty/</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p data-bbox="806 293 1986 423">DIGITAL REALTY DECREASES DATA CENTER COOLING ENERGY USAGE BY 66%</p> <p data-bbox="806 480 1776 630">Energy Management Software and Variable Speed Fans Dramatically Reduce Carbon Emissions, PUE</p> <p data-bbox="806 686 1915 836">San Francisco, CA – December 12, 2012 – Digital Realty Trust, Inc. (NYSE: DLR), Vigilent® Corporation, and Lawrence Berkeley National Laboratory today announced the results of a joint study focused on improving the energy efficiency of a data center designed, owned and operated by Digital Realty.</p> <p data-bbox="758 898 1919 930">https://www.vigilent.com/digital-realty-decreases-data-center-cooling-energy-usage-by-66/</p> <p data-bbox="753 1008 1919 1088">Vigilent instruments the white floor with sensors that continuously monitor temperatures at the server rack. Data from hundreds or thousands of temperature sensors is constantly and wirelessly transmitted to local gateways that aggregate the data before sending it to the AI Engine, which controls the cooling infrastructure.</p> <p data-bbox="753 1130 1934 1209">The Vigilent system makes control decisions designed to eliminate hot spots while avoiding unnecessary overcooling; at the same time, cooling units are automatically managed under dynamic control to ensure that the most optimal choices of CRACs or CRAHs are made, reducing your energy spend.</p> <p data-bbox="758 1271 1654 1304">https://www.vigilent.com/who-we-serve/by-role/data-center-designer/</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p data-bbox="766 267 1621 357">VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD</p> <p data-bbox="766 373 1150 402">Optimized airflow eliminates hot spots.</p> <p data-bbox="766 418 1113 568">Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management.</p> <p data-bbox="766 604 1113 779">Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.</p> <div data-bbox="1171 418 1696 776"></div> <p data-bbox="756 812 1591 844">https://www.vigilent.com/who-we-serve/by-facility/data-centers/.</p>

Claim 1

Exemplary Evidence of Infringement by Digital Realty

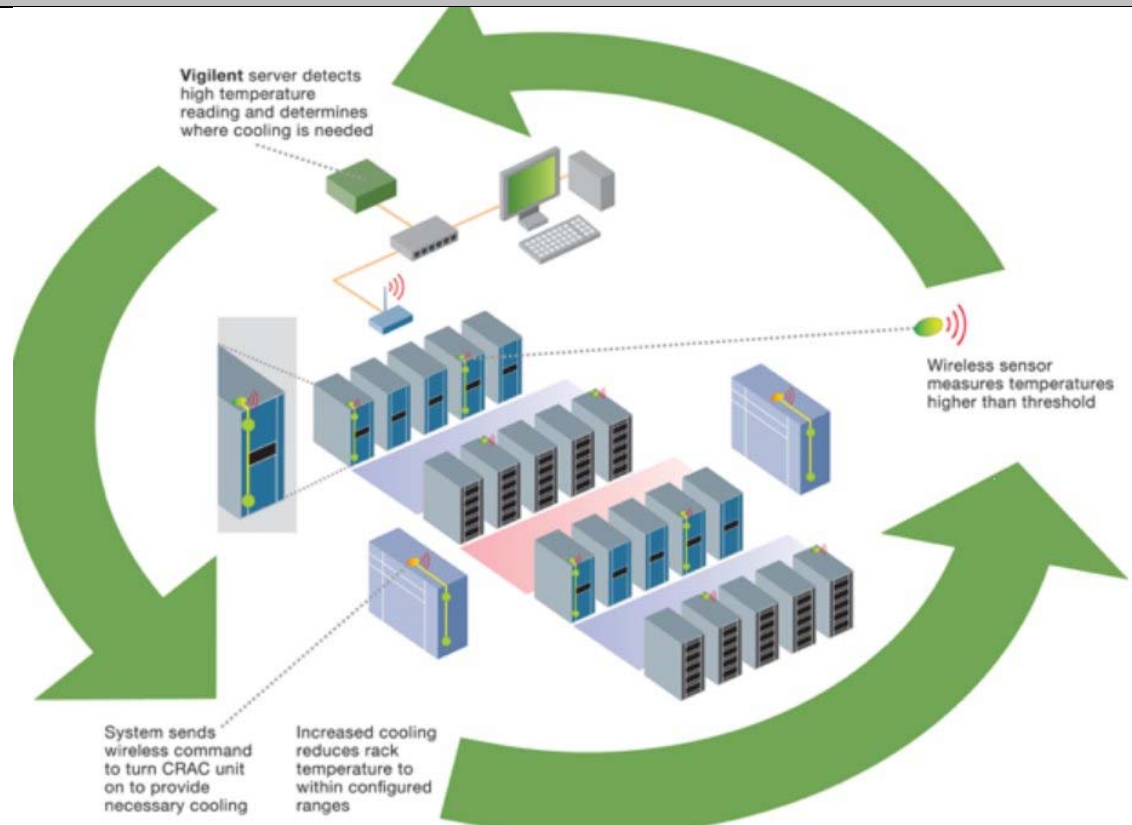


Constantly adapting

The AI engine constantly changes cooling when it detects new equipment and varying IT loads.

<https://www.vigilent.com/who-we-serve/by-facility/data-centers/>.

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p data-bbox="768 321 1121 354">Granular control & visibility</p> <p data-bbox="768 358 1614 456">The Vigilent system provides you with rack-level visibility, and automatically controls cooling resources to ensure you're getting the right amount of cooling to the locations you care about most.</p> <p data-bbox="756 480 1654 513">https://www.vigilent.com/who-we-serve/by-role/data-center-operator/.</p> <p data-bbox="756 537 1911 610">Vigilent also detects high temperature readings and sends command to the cooling units to control the temperature.</p> <p data-bbox="1035 646 1491 699">DYNAMIC CONTROL</p> <p data-bbox="1031 724 1461 805">Automatic, real-time thermal management.</p> <p data-bbox="1031 829 1570 1097">The Vigilent Control System combines the temperature data gathered by the monitoring system with powerful machine learning. It automatically determines how to best adjust your facility's cooling resources – constantly and in real time – to match the current heat load, all while using the minimum amount of energy possible.</p> <p data-bbox="756 1105 1986 1138">https://www.vigilent.com/products-and-services/vigilent-dynamic-cooling-management-system/</p>

Claim 1**Exemplary Evidence of Infringement by Digital Realty**

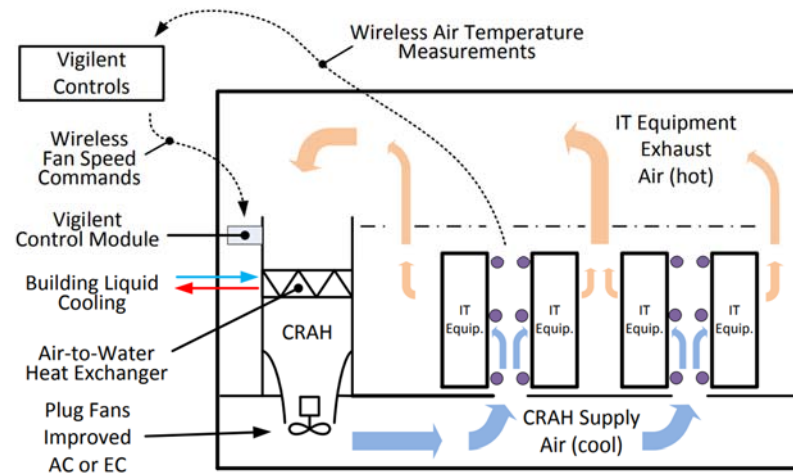
https://techcrunch.com/2012/03/26/vigilant-raises-6-7m-from-accel-for-intelligent-data-center-energy-management-system/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2x1LmNvbS8&guce_referrer_sig=AQAAAHN5ro4OJaRHQi5FRCMvqn2bp-tTxvWCI3YIbeLD

Claim 1**Exemplary Evidence of Infringement by Digital Realty**

The Cooling Capacity Report builds on Intelligent Analytics™ technology to display the amount of available cooling at each site, room, and individual cooling unit, on demand. This information enables facility managers to more quickly identify where equipment or racks can be shifted to improve cooling capacity and to distinguish between hot spots caused by airflow issues and those that indicate a facility is running at maximum capacity. As a result, additional IT load can frequently be added without the need for more cooling resources.


<https://www.vigilent.com/vigilent-brings-active-cooling-capacity-planning-to-dcim/>.

Closed Loop Wireless Control Diagram



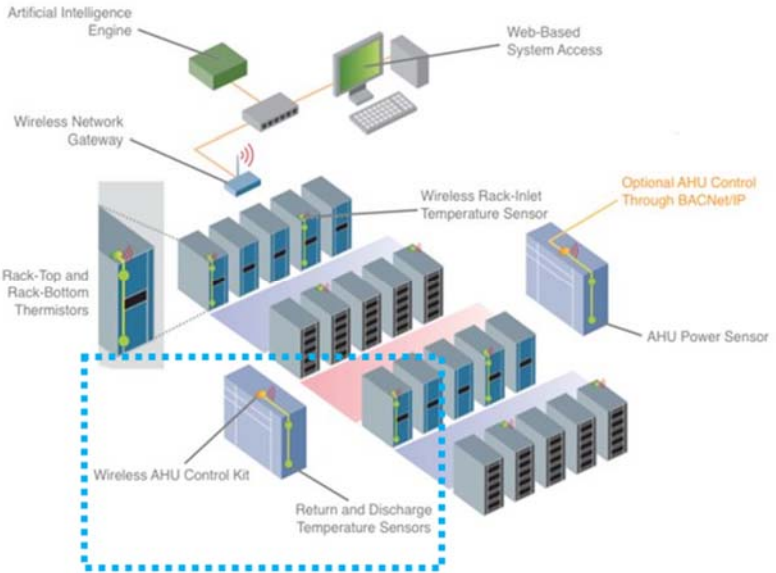
Source: Lawrence Berkeley National Laboratory High-Tech and Industrial Systems Group

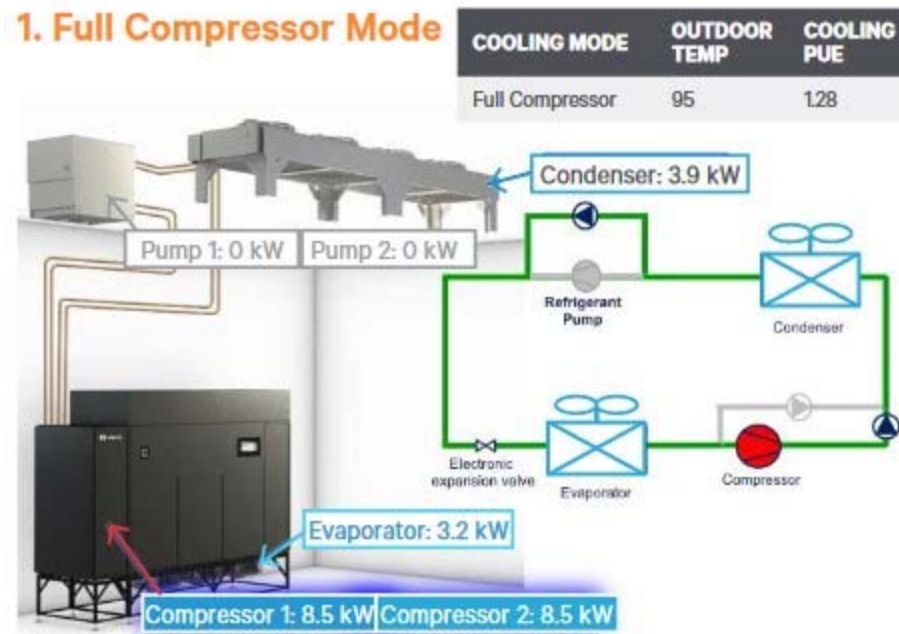
DIGITAL REALTY
Data Center Solutions

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	https://www.vigilent.com/wp-content/uploads/2014/06/DigitalRealty.pdf
<p>[1a] providing a plurality of heat exchanger units configured to receive air from said room and to deliver air to said room;</p>	<p>Digital Realty provides a plurality of heat exchanger units configured to receive air from said room and to deliver air to said room.</p> <p>For example, Digital Realty uses Liebert cooling units which are heat exchangers that receive air from the room and deliver cool conditioned air to the room by transferring heat from the air to a fluid.</p>  <p>The image shows a man in a grey short-sleeved shirt and glasses standing in a server room. He is reaching out to touch a small, square, illuminated control panel mounted on a large, dark grey Liebert cooling unit. The unit has the 'Liebert' logo visible on its side. The background shows other server racks and a hallway with orange walls and fluorescent lighting.</p> <p>https://www.youtube.com/watch?v=OmV1SFy5cEg at 1:43.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p>Vigilent’s dynamic cooling management activates the cooling units, that deliver and receive air from the room, and measures the return and discharge air temperatures.</p> <p>MONITOR STATUS</p> <p>CRAC, CRAH, and AHU temperature sensors constantly measure the discharge and return air temperatures of your cooling equipment. This data is stored indefinitely to enable the detection of long-term trends.</p> <p>https://www.vigilent.com/products-and-services/monitoring/</p> <p>You can track different cooling unit variables, including:</p> <ul style="list-style-type: none"> • BOP is the control output, which is how the Vigilent system can adjust cooling units by turning them on or off • Discharge Air is the temperature of air being supplied to the facility by the cooling unit • Power Monitor will display the amount of power in kilowatts (kW) being used by that equipment • Return Air is the temperature of the air coming back into the cooling unit • Return and Discharge Temperature Sensors – Measures the return air and discharge air temperature for each cooling unit <p>https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 2, 24.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<div data-bbox="938 310 1806 805" data-label="Diagram"> <p>The diagram, titled "IoT Architecture with Machine Learning" and branded with "SlidePlayer Vigilant", illustrates a system architecture. On the left, "Rack Sensors" (collecting temperature) and "Control Modules" (collecting cooling power and temperature data) are shown. These connect via "Gateways" (managing wireless communication) to a "Control" section containing an "AI Engine*" (aggregating data, learning, and issuing control commands). The AI Engine connects to "Prescriptive Analytics", which includes a "Data Engine" (analyzing cooling with predictive models) and an "Analytics UI" (providing "Insights to Action" to inform decision making). The final outcomes listed are: "Optimize Cooling Capacity", "Reduce Cooling Energy", and "Increase Cooling Reliability". A footnote states: "*AI Engine can be deployed in cloud or on site".</p> </div> <p data-bbox="751 885 1264 922">https://slideplayer.com/slide/12118919/</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	 <p>https://slideplayer.com/slide/12118919/.</p>
[1b] supplying said plurality of heat exchanger units with cooling fluid from an air conditioning unit;	<p>Digital Realty supplies said plurality of heat exchanger units with cooling fluid from an air conditioning unit.</p> <p>For example, Digital Realty uses Liebert's cooling units which have an evaporator. Refrigerant cooling fluid flows through heat exchanger coils in evaporator.</p>

Claim 1**Exemplary Evidence of Infringement by Digital Realty****1. Full Compressor Mode**

https://www.vertiv.com/49f1fd/globalassets/products/thermal-management/room-cooling/liebert-dse-sales-brochure-sl-18927_00.pdf

Digital Realty uses Liebert cooling units which have a chilled water control valve. Chilled water cooling fluid flows through heat exchanger coils in evaporator.

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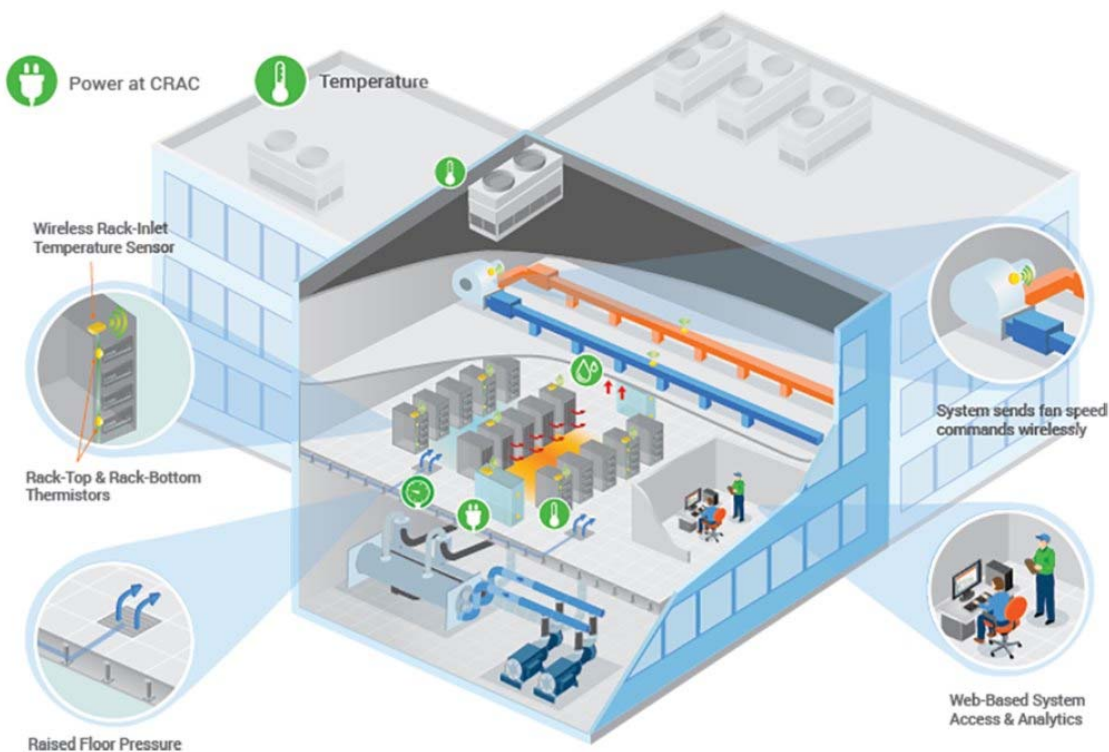
g capacities,
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Chilled Water Control Valve

The chilled water valve provides proportional control action in response to room temperature and humidity as sensed by the microprocessor control. It includes operating linkage and electronic motor. Unlike other systems of this nature it requires no over-travel linkage or end switches to be adjusted. The control uses "intelligent logic" to eliminate valve hunting, thus greatly increasing the life of the valve. The valve can be a 3-way or 2-way to meet the appropriate requirements of the installed system.

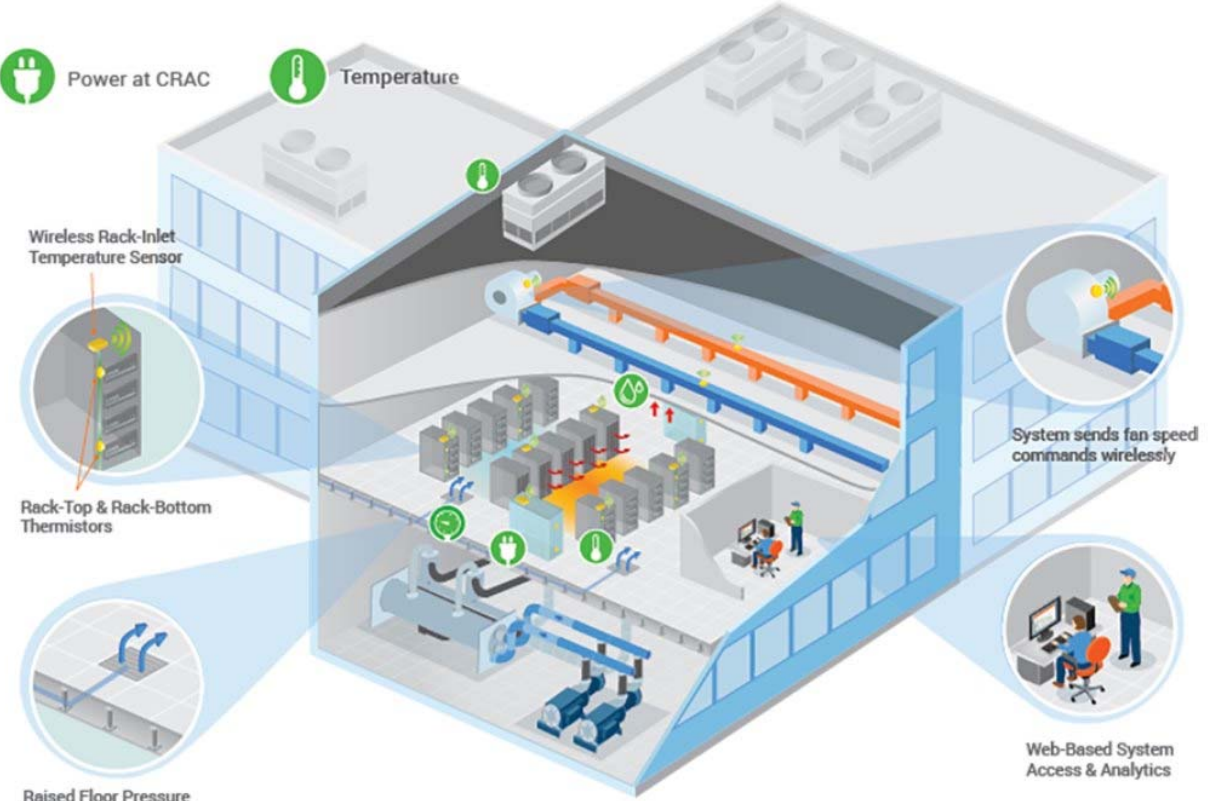


Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p data-bbox="758 261 1808 329">https://www.vertiv.com/491dda/globalassets/products/thermal-management/room-cooling/liebert-cw-brochure.pdf.</p> <div data-bbox="1060 500 1566 634"><p>Computer Room Air Conditioning unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAC units usually have multiple local compressors and self-contained refrigerant as the cooling agent.</p></div> <p data-bbox="1060 638 1125 657">CRAH</p> <div data-bbox="1060 662 1566 797"><p>Computer Room Air Handler unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAH units typically use chilled water as the cooling agent that is supplied from a central chilled water plant in the facility.</p></div> <p data-bbox="1060 800 1094 820">CT</p> <div data-bbox="1060 824 1528 878"><p>The Current Transducer (CT) is used with a power sensor to measure power of cooling units.</p></div> <p data-bbox="1060 881 1100 901">CW</p> <div data-bbox="1060 906 1566 985"><p>Chilled Water unit. A type of CRAC unit that uses chilled water from a dedicated, onsite chiller plant to cool the discharge air.</p></div> <p data-bbox="758 1049 1997 1154">Digital Realty also, or alternatively, uses Vigilent's dynamic cooling management which supplies chilled water to the Computer Room Air Handler unit, CRAH (heat exchanger units) from a central chilled water plant.</p> <p data-bbox="758 1239 1839 1307">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, Page 153.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	 <p>The diagram illustrates a data center environment with various monitoring and control components. Key elements include:</p> <ul style="list-style-type: none"> Power at CRAC: Indicated by a green plug icon. Temperature: Indicated by a green thermometer icon. Wireless Rack-Inlet Temperature Sensor: A sensor mounted on a server rack, with a circular inset showing a close-up of the sensor and its connection to a server rack. Rack-Top & Rack-Bottom Thermistors: Sensors located at the top and bottom of server racks. Raised Floor Pressure: Indicated by a green icon of a raised floor. System sends fan speed commands wirelessly: A circular inset showing a server rack with a fan speed control system. Web-Based System Access & Analytics: A circular inset showing a person at a computer monitor, representing remote access and analytics. <p>https://www.vigilent.com/products-and-services/monitoring/.</p>
<p>[1c] cooling said received air through heat exchange with the cooling fluid in the plurality of heat exchanger units;</p>	<p>Digital Realty cools said received air through heat exchange with the cooling fluid in the plurality of heat exchanger units.</p> <p>For example, Digital Realty uses Liebert cooling units to cool fluid (refrigerant) through the coil. The cooling fluid through the coil is chilled water/glycol. Liebert cooling units receive the “return air” from the room and deliver cool conditioned “supply air” to the room, by transferring heat from the air to the cooling fluid within the coil.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<div data-bbox="772 264 1986 854"> <p>The diagrams illustrate a room cooling system. On the left, 'Return Air' (indicated by three red arrows) enters from the top, passes through a 'Filter', then a 'Coil' (labeled 'FRONT'), and is pushed by a 'Blower' at the bottom to become 'Supply Air' (indicated by a blue arrow pointing left). On the right, the same components are shown, but the 'Supply Air' is pushed by the 'Blower' to the right (indicated by a blue arrow pointing right).</p> </div> <p>https://www.vertiv.com/4afe7d/globalassets/products/thermal-management/room-cooling/liebert-dse-80-165kw-23-43-tons-downflow-system-design-manual.pdf, pp. 3, 6.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p data-bbox="758 318 1997 350">Digital Realty also, or alternatively, uses Vigilent's dynamic cooling management which supplies</p> <div data-bbox="1060 386 1564 873"><p data-bbox="1060 386 1564 524">Computer Room Air Conditioning unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAC units usually have multiple local compressors and self-contained refrigerant as the cooling agent.</p><p data-bbox="1060 524 1123 548">CRAH</p><p data-bbox="1060 548 1564 686">Computer Room Air Handler unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAH units typically use chilled water as the cooling agent that is supplied from a central chilled water plant in the facility.</p><p data-bbox="1060 686 1092 711">CT</p><p data-bbox="1060 711 1528 768">The Current Transducer (CT) is used with a power sensor to measure power of cooling units.</p><p data-bbox="1060 768 1102 792">CW</p><p data-bbox="1060 792 1564 873">Chilled Water unit. A type of CRAC unit that uses chilled water from a dedicated, onsite chiller plant to cool the discharge air.</p></div> <p data-bbox="758 878 1927 943">chilled water to the Computer Room Air Handler unit, CRAH (heat exchanger units) from a central chilled water plant.</p> <p data-bbox="758 1032 1839 1097">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, Page 153.</p>

Claim 1	Exemplary Evidence of Infringement by Digital Realty
	 <p>https://www.vigilent.com/products-and-services/monitoring/.</p>
[1d] sensing temperatures at one or more locations in said room;	<p>Digital Realty senses temperatures at one or more locations in said room.</p> <p>For example, Digital Realty uses Liebert cooling units and the Liebert cooling unit control system senses temperatures at the supply sensor, remote sensor, or return sensor locations.</p>

Claim 1**Exemplary Evidence of Infringement by Digital Realty****3.1.12 Automatic Fan Speed Control**

Temperature sensors can control fan speed using one of three modes based on the type of sensor selected as the fan-control sensor: supply, return, or remote, see **Table 3.2** below. Control is based on the selected sensor for both fan control and temperature control and their setpoints as follows:

- Coupled: The fan control and temperature control sensor selection is the same. When coupled, fan speed is determined by the temperature setpoints.
- Decoupled: The fan control and temperature control sensor selection is different. When decoupled, fan speed is determined by the fan setpoints.

Table 3.2 Fan Speed Controlling Sensor Options

		Temperature Control Sensor Selected		
		Supply Sensor	Remote Sensor	Return Sensor
Fan Control Sensor Selected	Supply Sensor	Coupled	N/A	N/A
	Remote Sensor	Decoupled (Recommended)	Coupled	N/A
	Return Sensor	Decoupled	Decoupled	Coupled

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 45.

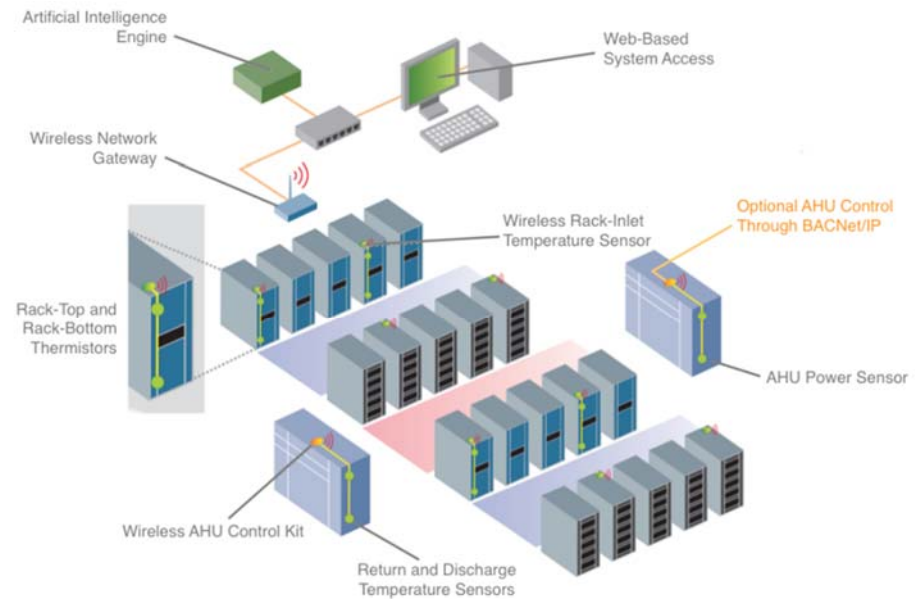
Digital Realty also, or alternatively, uses Vigilent's dynamic cooling management which reads rack sensors (deployed on the plurality of server racks) configured to measure inlet and outlet temperatures across the data center.

Claim 1**Exemplary Evidence of Infringement by Digital Realty**

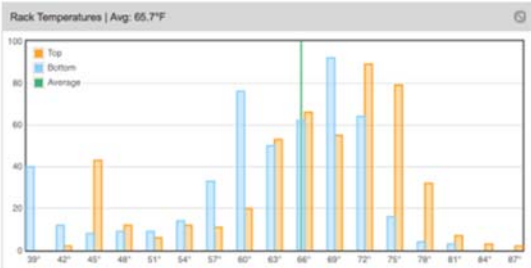
Wireless Rack-Inlet Temperature Sensor – Wireless sensor that measures temperature at the top and bottom of the rack inlet.

Rack-Top and Rack-Bottom thermistors – Attached via a cable sleeve, these are the physical monitoring points for each temperature sensor.

<https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF>, p. 2.

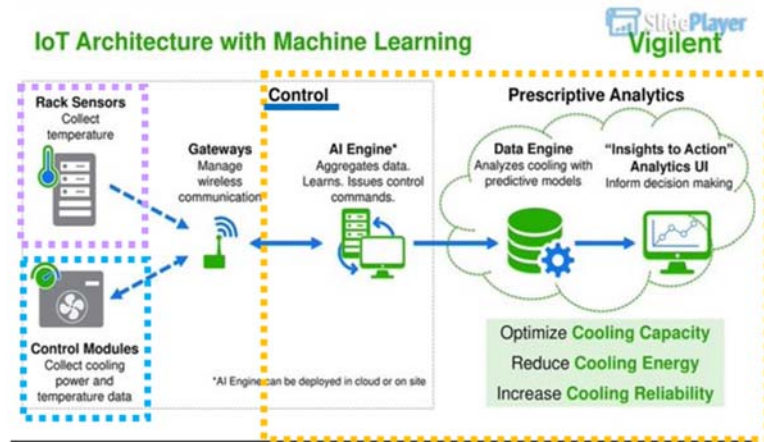


<https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF>, p. 1.

Claim 1	Exemplary Evidence of Infringement by Digital Realty																																																																																																																																																																																																								
	<div><table><caption>Rack Temperatures Avg: 65.7°F</caption><thead><tr><th>Rack Number</th><th>Top (°F)</th><th>Bottom (°F)</th><th>Average (°F)</th></tr></thead><tbody><tr><td>39</td><td>0</td><td>40</td><td>0</td></tr><tr><td>40</td><td>0</td><td>10</td><td>0</td></tr><tr><td>41</td><td>0</td><td>5</td><td>0</td></tr><tr><td>42</td><td>45</td><td>10</td><td>0</td></tr><tr><td>43</td><td>10</td><td>10</td><td>0</td></tr><tr><td>44</td><td>10</td><td>10</td><td>0</td></tr><tr><td>45</td><td>10</td><td>10</td><td>0</td></tr><tr><td>46</td><td>10</td><td>10</td><td>0</td></tr><tr><td>47</td><td>10</td><td>10</td><td>0</td></tr><tr><td>48</td><td>10</td><td>10</td><td>0</td></tr><tr><td>49</td><td>10</td><td>10</td><td>0</td></tr><tr><td>50</td><td>10</td><td>10</td><td>0</td></tr><tr><td>51</td><td>10</td><td>10</td><td>0</td></tr><tr><td>52</td><td>10</td><td>10</td><td>0</td></tr><tr><td>53</td><td>10</td><td>10</td><td>0</td></tr><tr><td>54</td><td>10</td><td>10</td><td>0</td></tr><tr><td>55</td><td>10</td><td>10</td><td>0</td></tr><tr><td>56</td><td>10</td><td>10</td><td>0</td></tr><tr><td>57</td><td>10</td><td>10</td><td>0</td></tr><tr><td>58</td><td>10</td><td>10</td><td>0</td></tr><tr><td>59</td><td>10</td><td>10</td><td>0</td></tr><tr><td>60</td><td>10</td><td>10</td><td>0</td></tr><tr><td>61</td><td>10</td><td>10</td><td>0</td></tr><tr><td>62</td><td>10</td><td>10</td><td>0</td></tr><tr><td>63</td><td>10</td><td>10</td><td>0</td></tr><tr><td>64</td><td>10</td><td>10</td><td>0</td></tr><tr><td>65</td><td>10</td><td>10</td><td>0</td></tr><tr><td>66</td><td>10</td><td>10</td><td>0</td></tr><tr><td>67</td><td>10</td><td>10</td><td>0</td></tr><tr><td>68</td><td>10</td><td>10</td><td>0</td></tr><tr><td>69</td><td>10</td><td>10</td><td>0</td></tr><tr><td>70</td><td>10</td><td>10</td><td>0</td></tr><tr><td>71</td><td>10</td><td>10</td><td>0</td></tr><tr><td>72</td><td>10</td><td>10</td><td>0</td></tr><tr><td>73</td><td>10</td><td>10</td><td>0</td></tr><tr><td>74</td><td>10</td><td>10</td><td>0</td></tr><tr><td>75</td><td>10</td><td>10</td><td>0</td></tr><tr><td>76</td><td>10</td><td>10</td><td>0</td></tr><tr><td>77</td><td>10</td><td>10</td><td>0</td></tr><tr><td>78</td><td>10</td><td>10</td><td>0</td></tr><tr><td>79</td><td>10</td><td>10</td><td>0</td></tr><tr><td>80</td><td>10</td><td>10</td><td>0</td></tr><tr><td>81</td><td>10</td><td>10</td><td>0</td></tr><tr><td>82</td><td>10</td><td>10</td><td>0</td></tr><tr><td>83</td><td>10</td><td>10</td><td>0</td></tr><tr><td>84</td><td>10</td><td>10</td><td>0</td></tr><tr><td>85</td><td>10</td><td>10</td><td>0</td></tr><tr><td>86</td><td>10</td><td>10</td><td>0</td></tr><tr><td>87</td><td>10</td><td>10</td><td>0</td></tr></tbody></table></div> <p>https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 4.</p> <h3>Wireless Sensors</h3> <p>Wireless sensors are typically deployed every third rack to measure the inlet air temperature every minute. The sensors have two thermistors, one to capture temperature at rack bottom, the other at rack top.</p> <p>Wireless sensors are also used to monitor return and supply air temperature, and the power consumed, by each cooling unit. Sensors are also available to measure other environmental conditions, namely pressure and humidity.</p> <p>The sensors are based on advanced mesh networking technology, which allows each node to be both a source and repeater for other nodes, allowing the network to automatically self-configure and be resilient to intermittent outages or changes in site layout.</p> <p>https://www.vigilent.com/technology/system-architecture/</p>	Rack Number	Top (°F)	Bottom (°F)	Average (°F)	39	0	40	0	40	0	10	0	41	0	5	0	42	45	10	0	43	10	10	0	44	10	10	0	45	10	10	0	46	10	10	0	47	10	10	0	48	10	10	0	49	10	10	0	50	10	10	0	51	10	10	0	52	10	10	0	53	10	10	0	54	10	10	0	55	10	10	0	56	10	10	0	57	10	10	0	58	10	10	0	59	10	10	0	60	10	10	0	61	10	10	0	62	10	10	0	63	10	10	0	64	10	10	0	65	10	10	0	66	10	10	0	67	10	10	0	68	10	10	0	69	10	10	0	70	10	10	0	71	10	10	0	72	10	10	0	73	10	10	0	74	10	10	0	75	10	10	0	76	10	10	0	77	10	10	0	78	10	10	0	79	10	10	0	80	10	10	0	81	10	10	0	82	10	10	0	83	10	10	0	84	10	10	0	85	10	10	0	86	10	10	0	87	10	10	0
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[1e] controlling at least one of the temperature of said cooling fluid and said air delivery by said plurality of heat exchanger units to said room in response to said sensed temperatures at said one or more locations; and	<p>Digital Realty controls at least one of the temperature of said cooling fluid and said air delivery by said plurality of heat exchanger units to said room in response to said sensed temperatures at said one or more locations.</p> <p>For example, Digital Realty uses Liebert cooling units which have temperate sensors that control fan speed in response to sensed temperatures.</p> <p>3.1.12 Automatic Fan Speed Control</p> <p>Temperature sensors can control fan speed using one of three modes based on the type of sensor selected as the fan-control sensor: supply, return, or remote, see <u>Table 3.2</u> below . Control is based on the selected sensor for both fan control and temperature control and their setpoints as follows:</p> <ul style="list-style-type: none">• Coupled: The fan control and temperature control sensor selection is the same. When coupled, fan speed is determined by the temperature setpoints.• Decoupled: The fan control and temperature control sensor selection is different. When decoupled, fan speed is determined by the fan setpoints. <p>Table 3.2 Fan Speed Controlling Sensor Options</p> <table><tr><th colspan="2" rowspan="2"></th><th colspan="3">Temperature Control Sensor Selected</th></tr><tr><th>Supply Sensor</th><th>Remote Sensor</th><th>Return Sensor</th></tr><tr><td rowspan="3">Fan Control Sensor Selected</td><td>Supply Sensor</td><td>Coupled</td><td>N/A</td><td>N/A</td></tr><tr><td>Remote Sensor</td><td>Decoupled (Recommended)</td><td>Coupled</td><td>N/A</td></tr><tr><td>Return Sensor</td><td>Decoupled</td><td>Decoupled</td><td>Coupled</td></tr></table> <p>https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 45.</p> <p>The Liebert cooling unit controls activates the flow of chilled water/glycol, and varies cooling capacity by adjusting a motorized ball valve.</p>			Temperature Control Sensor Selected			Supply Sensor	Remote Sensor	Return Sensor	Fan Control Sensor Selected	Supply Sensor	Coupled	N/A	N/A	Remote Sensor	Decoupled (Recommended)	Coupled	N/A	Return Sensor	Decoupled	Decoupled	Coupled
				Temperature Control Sensor Selected																		
		Supply Sensor	Remote Sensor	Return Sensor																		
Fan Control Sensor Selected	Supply Sensor	Coupled	N/A	N/A																		
	Remote Sensor	Decoupled (Recommended)	Coupled	N/A																		
	Return Sensor	Decoupled	Decoupled	Coupled																		

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	<p data-bbox="852 326 1381 350">7.1.4 Temperature Control with a Fluid Economizer</p> <p data-bbox="852 375 1713 440">When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint.</p> <p data-bbox="852 456 1667 501">The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.</p> <p data-bbox="758 574 1969 639">https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.</p> <p data-bbox="947 777 1730 1102">RWT Return water temperature. Measured temperature of the chilled water loop returning to the chiller. S SAT Supply Air Temperature. Measured temperature of the air leaving an AHU that is being supplied to the building zones.</p> <p data-bbox="758 1170 1986 1268">Digital Realty also, or alternatively, uses Vigilent's dynamic cooling management to generate an airflow for an optimal cooling output using the CRAH unit based on the temperature of the rack sensors.</p>

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	<p>Computer Room Air Conditioning unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAC units usually have multiple local compressors and self-contained refrigerant as the cooling agent.</p> <p>CRAH</p> <p>Computer Room Air Handler unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAH units typically use chilled water as the cooling agent that is supplied from a central chilled water plant in the facility.</p> <p>https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 157, 158</p>  <p>The diagram, titled "IoT Architecture with Machine Learning" and branded with "SlidePlayer Vigilant", illustrates a three-stage process. Stage 1, "Rack Sensors" and "Control Modules", collect temperature, cooling, power, and temperature data. Stage 2, "Gateways" and "AI Engine", manage wireless communication and aggregate data to learn and issue control commands. Stage 3, "Prescriptive Analytics", involves a "Data Engine" analyzing cooling with predictive models and an "Analytics UI" providing "Insights to Action" to inform decision making. The final outcomes are to "Optimize Cooling Capacity", "Reduce Cooling Energy", and "Increase Cooling Reliability". A note states: "*AI Engine can be deployed in cloud or on site".</p> <p>https://slideplayer.com/slide/12118919/</p>

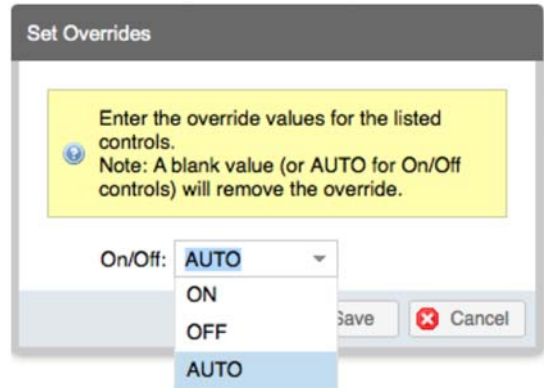
Claim 1	Exemplary Evidence of Infringement by Digital Realty
	<p>Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software.</p> <p>The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output to ensure that the thermal environment is maintained with a minimal amount of energy.</p> <p>The software then makes active control decisions for each cooling unit. The <u>Data Center Control</u> section provides more detail on the different control capabilities of the system. The real-time temperature monitoring provides thermal feedback as the software begins to control the environment. This constant monitoring and control response occurs automatically and dynamically to optimize your thermal environment.</p> <p>https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 102, 103.</p>
<p>[1f] wherein the step of controlling said air delivery by said plurality of heat exchanger units comprises individually manipulating a mass flow rate of the cooling fluid supplied to each of the plurality of heat exchanger units.</p>	<p>Digital Realty controls said air delivery by said plurality of heat exchanger units comprises individually manipulating a mass flow rate of the cooling fluid supplied to each of the plurality of heat exchanger units.</p> <p>For example, Digital Realty uses Liebert cooling units which have Teamwork mode. Teamwork mode evaluates changes in the air temperature of the inlet, outlet, or supply temperature of the heat dissipating devices and adjusts one or more cooling units controls to provide the required cooling capacity.</p>

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	<p data-bbox="779 272 1900 321">6 Teamwork, Standby and Rotation for Cooling Units</p> <p data-bbox="779 363 1959 423">U2U communication via private network and additional hardware (see U2U Networking on page 95) allows the following operating features for the cooling units:</p> <ul data-bbox="863 451 1098 558" style="list-style-type: none">• Teamwork• Standby (Rotation)• Cascade <p data-bbox="756 656 1969 721">https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 99.</p>

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	<p>6.2.3 Teamwork Mode 1—Parallel Operation</p> <p>In Teamwork mode 1, fan speed and cooling capacity are ramped up in parallel, which means that all units operate identically.</p> <p>Teamwork mode 1 is best for small rooms with balanced heat loads. A master unit collects the controlling readings for temperature and humidity from all the operating (fan on) units in the group, then determines the average or worst-case reading, and sends operating instructions to efficiently distribute cooling capacity across available units.</p> <p>In Teamwork mode 1, most parameters are shared and, when set in any unit, are set in all units in the group.</p> <p>6.2.4 Teamwork Mode 2—Independent Operation</p> <p>Teamwork mode 2 works well for most applications, and best in large rooms with un-balanced heat loads by preventing units in a group from operating in opposing modes, some cooling and some heating. All temperature and humidity parameters are shared by the group. The master unit monitors all available unit-sensor readings and determines the demand for cooling, heating, humidification and dehumidification, then sends operating instructions to address the greatest demand.</p> <p>In Teamwork mode 2, the setpoints for all units must be identical. The proportional band, deadband, and related settings may differ by unit. Fan speed is modulated per unit. Rotation and cascading is not available, so expect uneven distribution of work hours.</p> <p>6.2.5 Teamwork Mode 3—Optimized Aisle Operation</p> <p>In Teamwork Mode 3, the fan speed for all units operates in parallel, which means fan speed operation is identical at each unit. However, cooling capacity operates independently for each unit.</p> <p>Teamwork mode 3 takes advantage of variable speed fan options and variable capacity component options to maintain rooms with an unbalanced load and to prevent units in a group from operating in opposing modes. All units operate in the same mode based on the average or worst case (maximum) readings from the unit sensors. A local control (cooling capacity supply sensor) provides input to manage and maintain the discharge-air temperature at each unit. In addition, fan speed and operation are controlled based on readings from the unit temperature or static pressure sensors to control air delivery to the cold aisle.</p> <p>https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 102.</p>

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	<p>The Liebert cooling units also have standby mode. Standby mode evaluates changes in the air temperature of the inlet, outlet, or supply temperature of the heat dissipating devices and activates/de-activates one or more cooling units to provide the required cooling capacity.</p> <p>6.3 Assigning Cooling Units to Standby (Lead/Lag)</p> <p>Standby assigns some units to operate while others are on standby, meaning a unit is idle but ready to become active in the event of an alarm condition in one of the operating units or based on a rotation schedule.</p> <p>When a unit is in standby mode, fan(s) are off and no cooling occurs. In multiple cooling unit systems, assigning units to standby lets you:</p> <ul style="list-style-type: none"> • Configure redundancy in case of failure scenarios (standby). • Manage cooling unit run time (lead/lag). See Setting a Rotation Schedule on the next page . • Modulate for very low loads to full design load (to be temperature reactive) by cascading activation of standby units (configured when setting up teamwork mode). <hr/> <p>https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 103.</p> <p>Digital Realty also, or alternatively, uses Vigilent's dynamic cooling management to control the water flow supplied to each cooling unit automatically based on the measured temperature.</p> <p>CRAH Computer Room Air Handler unit. A standalone device sitting on the data center floor that provides cool air to the room via a fan. CRAH units typically use chilled water as the cooling agent that is supplied from a central chilled water plant in the facility.</p> <p>WtrFlow Measured volumetric water flow rate.</p>

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	<p data-bbox="758 261 1839 331">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 153.</p> <p data-bbox="758 367 1976 453">Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software.</p> <p data-bbox="758 477 1976 563">The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output to ensure that the thermal environment is maintained with a minimal amount of energy.</p> <p data-bbox="758 586 1976 703">The software then makes active control decisions for each cooling unit. The Data Center Control section provides more detail on the different control capabilities of the system. The real-time temperature monitoring provides thermal feedback</p> <p data-bbox="758 649 1976 703"><small>Thermal data is communicated via a wireless mesh network back to the control software. The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output to ensure that the thermal environment is maintained with a minimal amount of energy. The software then makes active control decisions for each cooling unit. The Data Center Control section provides more detail on the different control capabilities of the system. The real-time temperature monitoring provides thermal feedback.</small></p> <p data-bbox="758 764 1839 834">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 102, 103.</p> <p data-bbox="758 875 1350 899">How does the software control each cooling unit?</p> <p data-bbox="758 924 1976 1040">There are many differences in how a cooling unit can be controlled. Some units can only be turned ON and OFF. Some have Variable Frequency Drives (VFDs) for fan speed control, and others have been retrofitted with EC Plug Fans, which also have fan speed control. The Vigilent System is designed to work with all of these units and even a mix of different types.</p> <p data-bbox="758 1065 1976 1151">The Vigilent system controls the HVAC equipment to keep each zone temperature within its set point, configured by the user in the Set Points tab, while reducing airflow energy. The reduced airflow conserves energy by reducing fan power and putting less demand on chiller plants and boilers.</p> <p data-bbox="758 1174 1839 1243">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 104, 107.</p>

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	<div data-bbox="953 277 1493 662"></div> <ul style="list-style-type: none">• AUTO means the Vigilent system is in control of this unit and will turn the unit on or off automatically as necessary.• ON will turn the unit on, and disables the ability of the Vigilent system to control this unit. It will remain on until this override is removed.• OFF will turn the unit off, and disables the ability of the Vigilent system to control this unit. It will remain off until this override is removed. <p data-bbox="753 899 1839 971">https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 47.</p>